SECTION 075113 - BUILT-UP ASPHALT ROOFING, HOT APPLIED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes Roofing on Lightweight Concrete/Gypsum Concrete Deck:

a. Removal of existing roof system(s) down to deck.
b. Installation of a polyisocyanurate base insulation adhered Insulation on all roof areas Provide minimum R-30 value. Tapered where shown on the Drawings.
c. Installation of one-half inch (½") cellulosic fiber insulation board adhered.
d. Installation of built-up roof membrane consisting of four (4) plies imbedded into hot asphalt and a Polymer Modified Coal Tar flood coat with Gravel surfacing on all roofs.
e. Installation of three-ply base flashings system. Outer ply shall be granulated cap sheet.
f. Miscellaneous flashings and accessories.
g. Remove existing aluminum fascia and install new.
h. Provide owner with a 30 Year unlimited, non pro-rated manufacturer's labor and material warranty.

B. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:
1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashing.
2. Section 077129 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies
3. Section 02119 "Selective Demolition" for removal of existing roofing systems.
4. Section 061053 "Miscellaneous Carpentry" for wood nailers, cants, curbs, and blocking.

D. Unit Prices: Refer to Division 1 Section "Unit Prices" for description of Work in this Section affected by unit prices.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to Work of this Section.

1.4 PREINSTALLATION MEETINGS

Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For built-up roofing. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and built-up terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For built-up roofing to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is]FM Global approved for built-up roofing identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by built-up roofing manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing hot applied asphalt roofing systems; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive and issue the standard roofing manufacturer's warranty. Installing contractor shall not own, shall not be owned by, shall not be in a legal partnership with, or shall not be a subsidiary of or with, the roofing materials manufacturer. **APPLICATORS TO INCLUDE A LIST OF THREE (3) PROJECTS COMPLETED WITHIN THE LAST 5 YEARS, OF SIMILAR SIZE. INCLUDE NAMES AND ADDRESSES OF ARCHITECTS AND OWNERS, AND OTHER INFORMATION WITH BID.**

D. Installing contractor shall not own, shall not be owned by, shall not be in a legal partnership with, or shall not be a subsidiary of or with, the roofing materials manufacturer.

E. Inspection Reports: Provide copies of the roofing system manufacturer's inspection reports noted during and at the completion of the new roof installation. Manufacturer's Technical Representative must inspect roof installation every other day and report progress to Owner's representative. Provide progress photos for application of each operation of roofing system. In addition to regular inspections, Manufacturer's

Technical Representative shall be present for roof work starts at each section. **Manufacturer's Technical Representative shall provide proof of no less than 5 years experience in the Roofing Industry**

F. Provide evidence that the manufacturer to be employed on the project has ISO-9001 Certification.

G. Provide installer's field supervision. Installer must maintain full-time supervisor/foreman on job-site during times that roofing work is in progress. Supervisor must have a minimum of 5 years experience in roofing work similar to nature and scope of specified roofing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of built-up roofing that fail in materials or workmanship within specified warranty period.

1. Special warranty includes built-up roofing membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of built-up roofing.
2. Warranty Period:25 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of built-up roofing such as built-up roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

C. Manufacturer's Roofing Warranty: Submit a written warranty, signed by the roofing system manufacturer agreeing to promptly repair any leaks in the roof membrane system resulting from defects in materials or workmanship including, but not limited to, roof plies and adhesive, base flashings, roof insulations and adhesives, wood components, fasteners, and all roof system metal components for the indicated warranty period.

1. Manufacturer's 25-Year Systems Warranty.
2. BIDDERS TO PROVIDE COPY OF MANUFACTURERS WARRANTY WITH BID.
3. Warranty shall run for a continuous 25 years
4. Warranty will not be accepted that contains any requirement(s) for Owner to renew the warranty at any time during the 25 year period.

5. Upon successful completion of the work and prior to receipt of final payment, the manufacturer's warranty as stated above shall be issued to the Owner.

D. Applicator/Roofing Contractor Warranty: Submit roofing installer's written warranty, signed by the installer, covering work of this section, including but not limited to, roof plies and adhesive, insulation layers, base flashings, roof insulations, wood components, fasteners, and all roof system metal components for two years from the date of substantial completion. The warranty shall guarantee material and workmanship for watertightness, weathertightness, and against all leaks. During the two-year period, the contractor shall respond and fix all reported leaks within 24 hours from time of notification, and fix all leaks without any cost to the Owner.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Built-up Asphalt Roofing:

a. Tremco Incorporated.

b. SR Products

c. The Garland Company

d. Koppers Inc. (Coal Tar)

e. Durapax LLC (Coal Tar)

B. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

C. Source Limitations: Obtain components including roof insulation, fasteners and other products for built-up roofing from same manufacturer as built-up roofing or manufacturer approved by built-up roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed built-up roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Built-up roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by built-up roofing manufacturer based on testing and field experience.

C. FM Global Listing: Built-up roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification:Class 1A-90.
2. Hail-Resistance Rating: MH.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 ROOFING MEMBRANE SHEET MATERIALS

A. Base-Ply Sheet:
1. SBS-modified asphalt-coated composite polyester /fiberglass/polyester reinforced base sheet, ASTM D4601 Type II .
   a. Basis of design product: Tremco, BURmastic Composite Ply Premium.
   b. Tensile Strength, minimum, ASTM D5147: Machine direction, 229 lbf/in (40 kN/m); cross machine direction, 258 lbf/in (45 kN/m).
   c. Tear Strength, minimum, ASTM D5147: Machine direction, 392 lbf (1.7 kN); cross machine direction, 440 lbf (1.9 kN).
   d. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction 6 percent; cross machine direction 7 percent.
   e. Thickness, minimum, ASTM D146: 0.065 inch (1.65 mm).

B. Ply Sheets:
1. Asphalt and glass-fiber roofing ply sheet for hot-applied built-up roofing systems, ASTM D2178 Type VI .
   a. Basis of design product: Tremco, THERMglass Premium Type VI.
   b. Net Dry Mass of asphalt impregnated glass felt, ASTM D146: 9.5 lb/100 sq. ft. (460 g/sq. m).
   c. Breaking Strength, minimum, ASTM D146: Machine direction, 90 lbf/in (15 kN/m); cross machine direction, 70 lbf/in (12 kN/m).
   d. Pliability, 1/2 inch (13 mm), ASTM D146: Pass.

2.4 BASE FLASHING SHEET MATERIALS

A. Membrane Flashing Backer Sheet: Same product as Base-Ply Sheet

A. Membrane Flashing Sheet:

1. SBS/SIS/SEBS-modified asphalt-coated glass fiber reinforced sheet, granular surfaced, ASTM D6163 Type III Grade G.

   a. Basis of design product: Tremco, POWERply Plus HT FR.

   b. Exterior Fire-Test Exposure, ASTM E108: Class A.

   c. Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction 220 lbf/in (28 kN/m); Cross machine direction 220 lbf/in (29 kN/m).

   d. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 280 lbf (1315 N); Cross machine direction 300 lbf (1195 N).

   e. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 6.4 percent; Cross machine direction, 7.0 percent.

   f. Low Temperature Flex, maximum, ASTM D5147: -25 deg. F (-31 deg. C).

g. Thickness, minimum, ASTM D5147: 0.134 inch (3.4 mm).

h. Granule Color: White

B. Detailing Fabric:

1. Woven Glass Fiber Mesh, Vinyl-Coated: Non-shrinking, non-rotting, vinyl-coated woven glass mesh for reinforcing flashing seams, membrane laps, and other roof system detailing.

a. Basis of design product: Tremco, BURmesh.

b. Tensile strength, 70 deg. F, min ASTM D146: Warp, 65 lbf/in (285 N); fill, 75 lbf/in (310 N).

c. Color: Aqua green.

2.5 ASPHALT MATERIALS

A. Asphalt primer, ASTM D41, low-VOC.
1. Basis of design product: Tremco, TREMprime LV.
2. Volatile Organic Compounds, maximum, ASTM D3960: 350 g/L.
3. Total solids, ASTM D41: 45 percent.

C. Roofing Asphalt: : (interply) Hot-melt asphalt adhesive, SEBS-modified elastomeric, ASTM D6152.

1. Basis of design product: Tremco, THERMastic 80 Adhesive.

2. Softening Point, min/max, ASTM D36: 195-205 deg. F (90-95 deg. C).

3. Flash point, minimum, ASTM D92: 525 deg. F (274 deg. C).

4. Low Temperature Flexibility, maximum, ASTM D3111: 18 deg. F (-8 deg. C).

5. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D412: 800 percent.

6. Elastic Recovery, minimum, ASTM D412: 95 percent.

B. Coal-Tar Primer: ASTM D 43.

C. Modified Coal-Tar Pitch: (Flood Coat Only) meeting the following requirements:

Elongation – 2,000% - ASTM D412
Tensile Strength – 100 PSI – ASTM D412
Softening Point - 130° - 155°F – ASTM D36

2.6 AUXILIARY BUILT-UP ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Flashing Sheet Adhesive:
1. Hot-melt asphalt adhesive, SEBS-modified elastomeric, ASTM D6152 .
   a. Basis of design product: Tremco, THERMastic 80 Adhesive.
   b. Softening Point, min/max, ASTM D36: 195-205 deg. F (90-95 deg. C).
   c. Flash point, minimum, ASTM D92: 525 deg. F (274 deg. C).
   d. Low Temperature Flexibility, maximum, ASTM D3111: 18 deg. F (-8 deg. C).
   e. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D412: 800 percent.
   f. Elastic Recovery, minimum, ASTM D412: 95 percent.

C. Asphalt Roofing Cement / Mastic:
1. Roof Cement, Asphalt-Based: ASTM D4586, Type II, Class I, fibrated roof cement formulated for use in installation and repair of asphalt ply and modified bitumen roofing plies and flashings; UL-classified for fire resistance.
   a. Basis of design product: Tremco, ELS.
   b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 190 g/L.
   c. Non-Volatile Matter, ASTM D4586: 85 percent.
   d. Resistance to sag ASTM D4586: 1/8 in. (3 mm).

D. Elastomeric Mastic:
1. Roofing Mastic, Low-Volatile: Modified asphalt elastomeric roof mastic, one-part, trowel-grade, formulated for compatibility and use with specified roofing membranes and flashings.
   a. Basis of design product: Tremco, POLYroof LV.
   b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 300 g/L.
   c. Elongation at -30 deg. F (-34 deg. C), minimum, ASTM D412: 100 percent.
   d. Tensile strength at 77 deg F (25 deg C), ASTM D412: 30 psi (207 kPa).
   e. Flexibility at -40 deg. F (-40 deg. C), ASTM D3111: No cracking.
   f. Nonvolatile matter, ASTM D4586 : 70 percent.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening built-up roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.

F. Aggregate Surfacing: ASTM D 1863, No. 6 or No. 67, clean, dry, opaque, 3/8 " white roofing spar. .

G. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

H. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."

I. Lead Flashings: Plumbing stacks and Drain Bowls: 4 lb. sheets ASTM B29-79

J. Termination Bar: .060" thick aluminum bar x 2" wide x 10' lengths. Fastener spacing 8" o.c.

K. Gasket Sealant: TF Tape; Two sided, butyl adhesive, 1" x 1/8 compression tape for termination bars.

L. Pitch Pocket mastic: 2 component Pourable Pitch Pocket, ASTM C920, Type M.

M. Substrate Board: ASTM C 1278/C 1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate,1/2 inch(13 mm)thick.

N. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.
1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.

B. Polyisocyanurate Board Insulation: ASTM C 1289,Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
   a. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).
   b. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope as indicated on the drawings. unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.

B. Roof Insulation Adhesive:
   1. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.
      a. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.
      b. Flame Spread Index, ASTM E84: 10.
      c. Smoke Developed Index, ASTM E84: 30.
      d. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.
      e. Tensile Strength, minimum, ASTM D412: 250 psi (1720 kPa).
      f. Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.50 kN/m).
      g. Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Wood Nailer Strips: Comply with requirements in Section 061053 "Miscellaneous Rough Carpentry."

E. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

F. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board,1/2 inch(13 mm)thick.

2.9 SURFACING MATERIAL

A.

Roof Coating: Modified Coal-Tar Pitch: (Flood Coat Only) meeting the following requirements:

Elongation–2,000%-ASTM-D412 Elongation – 2,000% - ASTM D412
Tensile Strength – 100 PSI – ASTM D412
Softening Point - 130° - 155°F – ASTM D36

B. Aggregate Surfacing Material:

   1. Aggregate Stone Surfacing: Clean, dry, opaque, water-worn or crushed stone, free of sharp edges.
      a. Basis of design product: Aggregate Stone Surfacing.
      b. Size, ASTM D 1863: No. 6 or 67.
      c. Aggregate application rate, average: 400 lb/100 sq ft (19.5 k/m2)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

    a. Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with Work of this Section if test sample foams or can be easily and cleanly stripped after cooling.

6. Verify that concrete curing compounds that impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Install insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

A. Comply with built-up roofing manufacturer's written instructions.

B. Asphalt Heating: Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application. Circulate asphalt during heating. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating. Do not heat asphalt within 25 deg F (14 deg C) of flash point. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

1. Apply hot roofing asphalt within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

C. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Install one lapped base-sheet course and mechanically fasten to substrate according to built-up roofing manufacturer's written instructions.

D. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.

E. Install tapered insulation under area of roofing to conform to slopes indicated.

F. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding1/4 inch(6 mm)with insulation.

1. Cut and fit insulation within1/4 inch(6 mm)of nailers, projections, and penetrations.

G. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is2.7 inches(68 mm)or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of6 inches(150 mm)in each direction.

1. Where installing composite and noncomposite board insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

I. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

J. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in urethane foam.

K. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

L. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of6 inches(150 mm)in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing manufacturer.
1. Apply urethane foam to underside and immediately bond cover board to substrate.

3.5 BUILT-UP ROOFING INSTALLATION, GENERAL

A. Install roofing according to roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
1. Base-Ply Sheet: One.
   a. Adhering Method: Mopped.
2. Number of Ply Sheets: Three.
   a. Adhering Method: Mopped.
3. Surfacing Type: A (aggregate).

B. Start installation of built-up roofing in presence of manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24), install built-up roofing sheets parallel with slope.

1. Backnail built-up roofing sheets to substrate according to roofing manufacturer's written instructions.

D. Coordinate installation of roofing so insulation and other components of built-up roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed built-up roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
3. Remove and discard temporary seals before beginning work on adjoining roofing.
4. Splice each section at the start of each day as per the detail on the drawings.

3.6 ROOFING MEMBRANE INSTALLATION

A. Install four ply sheets starting at low point of roofing. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.

1. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

B. Glaze-coat roofing membrane surface with hot coal-tar pitch applied at a rate of 10 to 15 lb/100 sq. ft. (0.5 to 0.73 kg/sq. m) if aggregate surfacing is not applied immediately.

C. Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with 70 lb/100 sq. ft. (3.5 kg/sq. m) of hot coal-tar pitch. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:

1. Aggregate Weight: 400 lb/100 sq. ft. (20 kg/sq. m).

3.7 FLASHING AND STRIPPING INSTALLATION

A. Install 3 layers of base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
3. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Install stripping, according to roofing system manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.

1. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C), and extend onto roofing membrane.
2. Flashing-Sheet Stripping: Install flashing-sheet stripping by heat welding and extend onto roofing membrane.
3. Built-up Stripping: Install stripping of not less than 2 roofing membrane ply sheets, setting each ply in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt, and extend onto roofing membrane 4 inches (100 mm) and 6 inches (150 mm), respectively.

E. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with stripping and extend a minimum of 4 inches (100 mm) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

1. Install flashing-sheet stripping by same method as installing base flashing.
2. Install stripping of not less than two roofing membrane ply sheets, each set in a continuous coating of asphalt roofing cement or in a solid mopping of hot roofing asphalt.

3.8 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
1.

D. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. lightning;
   b. peak gust wind speed exceeding <**Insert mph** (m/s);>
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075113